ABSTRACT

DANSA, Manuchi Martins. *Sliding Mode Control for a Class of Nonlinear Biological and Chaotic Systems with Uncertainties.* 000 f. Dissertation (Master Degree Course in Electronic Engineering) - Faculdade de Engenharia, Rio de Janeiro State University (UERJ), Rio de Janeiro, 2019.

In this dissertation, control strategies are proposed in order to stabilize uncertain, nonlinear and monovariable systems of arbitrary relative degree in such a way that only output feedback is used. In particular, it is desired to achieve local or global stabilization of two classes of systems: feedforward-like systems and strict-feedback systems. To deal with the plant uncertainty problem, the control laws adopted will be based on robust control by sliding modes, whether these are continuous or switched in nature. In addition, to compensate for the relative excess degree, it is necessary to design a sliding variable that is described from a linear combination of the output and its derivatives. In this context, the need arises to use a robust and exact differentiator, based on sliding modes of higher order and fixed gain. Since this gain depends on the state vector of the plant, the use of observers of the cascade norm is necessary to estimate the unknown portion of the state. Such an estimate can be made from knowledge of upper and lower limiting uncertain system parameters. Thus, by exploiting ISS (Input-to-State Stable / Stability) properties of the systems under study, it is possible to guarantee that the proposed controllers are able to stabilize globally or to regulate locally the considered systems. Chaotic and biological systems are taken as applications of the proposed algorithms. As for chaotic systems, a secure communication scheme is proposed by using the synchronization of chaotic oscillators of a master-slave system. With regard to biological systems, it is desired to regulate blood glucose in Type 1 diabetic patients.

Keywords: Sliding Mode Control. Output Feedback. Input-State Stability. Feedforward-like systems. Strict-feedback systems.